

[Material Description] [Portland Cement Concrete] [Granular Base]

RECLAIMED CONCRETE MATERIAL

User Guideline

Embankment or Fill

INTRODUCTION

Although the use of reclaimed concrete material (RCM) in embankments or fill may not make the best use of the high quality aggregates associated with RCM, where no other applications are readily available, RCM can be satisfactorily used in this application. RCM aggregates are considered by many specifying agencies to be conventional aggregate. It requires minimal processing to satisfy the conventional soil and aggregate physical requirements for embankment or fill material.

The lower compacted unit weight of RCM aggregates compared with conventional mineral aggregates results in higher yield (greater volume for the same weight), and is therefore economically attractive to contractors. In addition, for large reconstruction projects, on-site processing and recycling of RCM is likely to result in economic benefits through reduced aggregate hauling costs.

PERFORMANCE RECORD

RCM has demonstrated satisfactory performance as an embankment or fill material. Its use is covered by special provisions to specifications in a number of jurisdictions. Desirable attributes of RCM for use in embankments or fill include high friction angle, good bearing strength, negligible plasticity, and good drainage characteristics.

Due to its high alkalinity, RCM in contact with aluminum or galvanized steel pipes can cause corrosion in the presence of moisture.

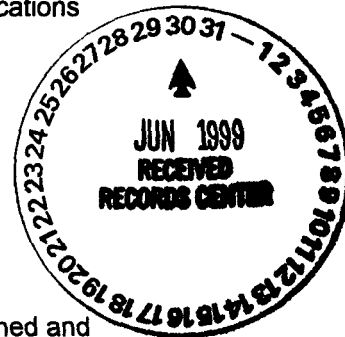
A potential for tufa-like precipitates to leach from RCM in granular base applications has been described in the literature,⁽¹⁾ and may also be a consideration in embankment or fill applications.

MATERIAL PROCESSING REQUIREMENTS

Crushing and Screening

Prior to its use, any reinforcing steel must be removed and RCM must be broken or crushed and screened to satisfy the maximum size and gradation requirements for use in embankment construction.

Where the processed RCM contains some reclaimed asphalt pavement (RAP), which can occur when the RCM is derived from composite pavements, it is recommended that the RAP content in the RCM be limited to 20 percent to prevent a reduction in bearing strength due to the presence of RAP.⁽²⁾

**ADMIN RECCRD**

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Washing

Washing of RCM aggregates is required by some agencies to remove the dust as a measure to reduce tufa formation potential. To control tufa precipitate formation, only suitable RCM that does not contain significant quantities of unhydrated cement or free lime should be used for embankment or fill applications.

Testing

Additional quality control testing (leachate testing) may be necessary to assess the tufa precipitate potential of RCM aggregates for embankment applications. A special procedure to identify the potential for tufa formation in steel slags was developed, which should be appropriate for RCM testing ⁽³⁾

ENGINEERING PROPERTIES

Some of the engineering properties of RCM that are of particular interest when RCM is used as an embankment or fill material include gradation, specific gravity, stability, strength, durability, drainage, and corrosivity.

Gradation RCM must be crushed and screened to satisfy AASHTO M145⁽⁴⁾, and ASTM D2940 ⁽⁵⁾ gradation requirements for embankment or fill aggregates.

Specific Gravity The specific gravity of RCM aggregates (ranging from 2.0 for fines to 2.5 for coarse particles) is slightly lower than that of virgin aggregates ⁽⁶⁾

Stability RCM has high friction angle, typically in excess of 40° and consequently demonstrates good stability and little postcompaction settlement.

Strength Characteristics Processed RCM, being 100 percent crushed material, is highly angular in shape. It exhibits California Bearing Ratio (CBR) values ranging from 90 to more than 140 percent (depending on the angularity of the virgin concrete aggregate and strength of the Portland cement matrix), which is comparable to crushed limestone aggregates ^(7, 8)

Durability RCM aggregates generally exhibit good durability with resistance to weathering and erosion.

Drainage Characteristics RCM (mainly coarse fraction) is free draining (more permeable than conventional granular material due to lower fines content). RCM is nonplastic and is not susceptible to frost.

Corrosivity The high alkalinity of RCM (pH greater than 11) can result in corrosion to aluminum or galvanized steel pipes in direct contact with RCM and in the presence of moisture ⁽⁹⁾

DESIGN CONSIDERATIONS

The design requirements for RCM in embankment construction are the same as for conventional aggregates. There are no standard specifications covering RCM use as embankment or fill material.

Structural design procedures for embankments or fill containing RCM are the same as design procedures for embankments or fill containing conventional materials

CONSTRUCTION PROCEDURES

Material Handling and Storage

The same methods and equipment used to store or stockpile conventional aggregates are applicable for reclaimed concrete material. Some jurisdictions (Ontario, Canada, for example) may restrict stockpiling and placement of RCM near watercourses to minimize the impact of the alkaline leachate on ambient water quality. Appropriate procedures may also be required to avoid segregation of coarse and fine materials during handling and storage. These include stockpile construction using radial stackers, with remixing using a front-end loader or bulldozer prior to load-out, and care during load-out and placement.

Placing and Compacting

Due to their high angularity, additional effort (for instance using vibratory rollers) may be required to compact RCM to its maximum density. The processor may be required to satisfy moisture content criteria according to AASHTO T99,⁽¹⁰⁾ in order to achieve good compactibility. This usually requires the addition of water during placement and compaction.

Quality Control

The same test procedures used for conventional aggregate are appropriate for embankment applications when using RCM. Standard laboratory and field tests for compacted density and field measurement of compaction are given by AASHTO test methods T191⁽¹¹⁾, T205⁽¹²⁾, T238⁽¹³⁾ and T239⁽¹⁴⁾.

Special Considerations

To avoid corrosion problems, RCM should not be placed in contact with aluminum or galvanized steel pipes. Caution is also warranted in locations subject to wet conditions, as tufa-like precipitates (CaCO_3) associated with the leachate from RCM may develop upon exposure to the atmosphere.⁽¹⁾

UNRESOLVED ISSUES

Although problems associated with tufa precipitate formation in embankments containing RCM have not been identified, a study of the subject would provide useful technical data to better define the nature and degree of the problem, and to affirm the use of RCM in embankment construction.

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